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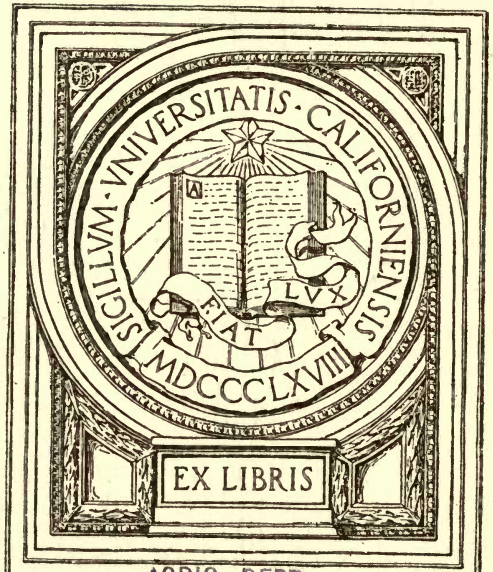

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A BULLETIN

ON

ORCHARD PRACTICE

COMPILED BY

F. A. HUNTLEY

State Commissioner of Horticulture

TACOMA, WASHINGTON,

March, 1906.

OLYMPIA, WASH.
C. W. GORHAM, PUBLIC PRINTER.
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(Washington State) State board of horticulture.

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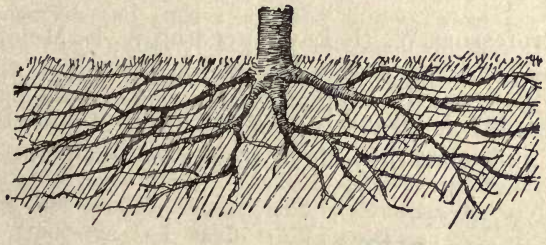

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ACKNOWLEDGMENTS.

This bulletin is not intended to appear as an exhaustive treatise on the subjects presented, but its aim is to serve as a brief guide for those who are in need of such information.

Professors W. H. Lawrence and A. L. Melander of the State College have very kindly furnished the articles for this publication, which are credited to them, and what they have to say is fresh and up to date.

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A BULLETIN ON ORCHARD PRACTICE.

PRUNING ORCHARD TREES.

By F. A. Huntley.

Pruning is indispensable to the profitable cultivation and training of fruit trees and plants. Nature prunes and trains in a crude fashion but does not cultivate. Cultivation breaks into the natural habits of plants, intensifies development, and causes a demand for more intensive processes. Natural conditions and artificial methods are wholly different and opposed in their application. Take fruit trees or plants of any kind, which have been established in variety form by methods of propagation and cultivation, and subject them to natural conditions, namelv that of neglect, and they will usually revert to a lower constitutional vigor than their immediate ancestry. To maintain high standards in cultivated plants it is, therefore, necessary to fulfill all the requirements of domestication.

The purpose of this article is to give a few hints on the pruning of orchard trees. Limited space here forbids going at length into details. No attempt is made on the subjects of pruning vineyards and small fruits, as these are matters extensive within themselves.

There are many reasons why trees and other plants are pruned, and there seems to be a general demand for enlightenment upon this important subject.

Pruning is done on young trees to start an even balance of root and top at the time of transplanting. Trees two years old and over, especially, suffer considerable loss at the roots when taken up for transplanting, and it is usually advisable to reduce the tops to correspond. A reduced root system will not well maintain the vigor of a normally developed top.

Again it is advisable to prune young trees to establish shapely form. The ideal is the yearling tree to commence with, for it is then possible to shorten the single stem to the

point where it is desired to form the head, or establish a system of branching. This can be done also with an older tree, and is usually necessary, as the commercial kind is generally two years old or over at the time of transplanting. Do not be afraid to cut the young tree back to the height desired. Low heading of fruit trees has come to be an almost universal practice and there are a number of good reasons for this. Tops low down admit of economy in harvesting the fruit, ease and effectiveness of spraying, convenience in pruning, shading the ground at the base of the tree and thus conserving moisture, less exposure to winds, protection from sun scald; and if a tree is properly pruned during its young life it will maintain a more open habit of branching throughout its existence than a "tassel top" which is the natural tendency in high heading.

"As a rule, all apple, pear, and sweet cherries ought to be headed not higher than twenty to twenty-four inches from the ground, and all stone fruits, such as plum, prune, apricot, peach, nectarine, etc., may, with advantage, be headed a little lower, say twelve to fifteen inches from the ground."

The pruning of bearing apple orchards is a subject upon which, perhaps, more are interested than any other in the line of pruning. It has for its objects the renovating of old trees, thinning to facilitate spraying and to admit light, and the removal of injured, crooked and crossed branches. It is also desirable to maintain symmetry of growth. It is too common a mistake to neglect pruning for several seasons and then to over-prune at one time. Pruning is usually done in late winter and early spring, before the buds swell, and is the proper time as a rule. Pruning should be done every season, and not much at a time. Avoid cutting off large limbs excepting in cases of evident necessity. The effect of removing much wood growth in the dormant season is to direct the energy of the tree to making new wood which will appear as "water sprouts" and long succulent branches. Always cut close to the base when taking off limbs. Do not leave stubs, as they may require a season or two to die back to the base before the wound will commence to heal and cover the injury. In the meantime decay may set in and injure the main stem upon which the cut was made. After wounds have remained exposed long enough, a few days after pruning, so the sur-

faces may dry, they should be covered with some kind of dressing to exclude air and moisture and prevent decay. Wax, varnish, or paint, may be used for this purpose. Thick white-lead paint is one of the best dressings, and is easy to apply. Make clean cuts with a sharp pruning saw, pruning shears, or a sharp knife. The size of cut to be made will determine the tool to be used.

Pruning the tree during the active stages of growth disturbs the harmony of action between roots and top and causes a check to the wood development. In other words, summer pruning tends to dwarf hard wooded plants. Prof. J. A. Balmer makes comparison of the effects of winter and summer pruning as applicable to the extreme eastern and western sections of this state, in the following: "Let us first observe the conditions prevailing in Eastern Washington." (Above the irrigated valleys.) "Here we have a long, dry summer, with a fierce, scorching sun, and strong, drying winds, with a maximum rainfall of probably less than eighteen inches per annum, followed by a severe winter with fluctuating temperatures, and sudden changes. In portions of the fruit belt there is barely enough natural moisture in the ground to sustain a tree. Under these conditions who can wonder that trees on the east side come to maturity at an early age, and produce fruit at a time in their lives when they ought to be making wood growth, and establishing a strong, healthy frame for future usefulness. There is no question in my mind, as to what is the proper method to adopt in pruning our fruit trees on the east side of the mountains. We must prune in the winter and prune hard. The tendency of all our young trees is to run to premature fruiting. Cherries carrying a crop of fruit at two years old, and pears and apples bearing full crops at five and six years old. To overcome this tendency in our trees we must practice a system of pruning that is conducive to wood and leaf growth, and to discourage all forms of summer pruning and pinching."

"Trees on the west side of the mountains should be treated a little differently. In most sections on the west side, and especially in the warmer valleys, trees make an extraordinary wood growth. It is no uncommon thing to find young prunes and cherries making a growth of six to ten feet in a single

season. The excessive moisture in soil and atmosphere, and the mild climate, are conducive of this rapid growth. Trees grow late in the season, and there is some difficulty in securing thoroughly ripened wood. To cut back severely in winter aggravates the evil, more and longer wood is the result. The way to check this excessive growth is to resort to summer pruning and pinching and even to root pruning."

All of what has been said is applicable to plants in general. It may be well to add a little specifically about certain fruits.

The apple is generally regarded as a tree of greatest permanence. With this in view it becomes a matter of importance to take into consideration a long future development. Low heading has been indicated as a preference. An even balance of top on all sides is desirable. About three, and not to exceed four main branches should make up the frame structure. If the lowest branch starts at twenty-four inches above the ground line, then the second branch should begin not less than six inches above the first, and so on. In the old tree, with its greatly increased diameter, the branches will then seem to begin at very nearly the same point. If the tree is to have three main branches they should be selected to alternate from about three equal sides of the trunk to insure symmetry of form and correct balance in the weight of top. The after-pruning should be directed towards maintaining this balance and symmetry throughout the life of the tree. A very little pruning each year should suffice thereafter.

The pear tree requires about the same treatment as the apple, with perhaps a little more freedom in branching as in the case of some varieties of erect habit. By some growers it is considered advisable to shorten each of the main branches to about one-third its length after the first season's growth, and continue this shortening process until the tree comes in bearing. A young pear tree is inclined to produce a great many fruit spurs along the main branches. These should be kept rubbed off. If the trees are of great vigor it should be done in the summer but if growth is only moderate the winter is the best time. The main object in this is to insure smooth, clean branches, which is a protection from disease. It has been fully demonstrated that pear blight gains entrance to a tree through the blossoms by the visits of insects from in-

fested trees. If flowers appear only on the smaller growths the diseased limbs can be cut out with little damaging results.

The peach tree is a rapid and vigorous grower. The fruit is always borne on wood grown the previous season. Fruit spurs are not formed as in the case of the apple and pear. One-year-old trees are the most desirable for planting. Most growers prefer heading the trees only a little above the ground line, with three or four main branches. The annual growths are usually very long, and until the tree comes into full bearing it is best to practice shortening back considerably each annual growth earlv in the spring or late winter. In fact the heading back process should always continue, to insure compact, shapely trees and a uniform distribution of fruit. Systematic annual pruning is much to be preferred to the practice by many of neglecting to prune for a number of seasons and after a few years starting a new head by cutting the top back to a mere stump. Such cutting back seldom produces satisfactory results.

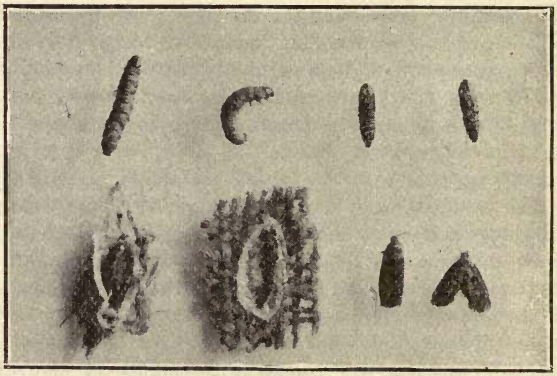
The cherry, and also the plum, should be pruned but very little after a system of correct branching has been started. Sometimes it happens that a vigorous side branch will start and grow to excessive length in the young sweet cherry, and plum. It is well to head back such branches in the growing season to a proportionate length. Prune also to avoid the formation of sharp crotches which are apt to separate in the aged tree. Crotches are likely to form where two branches of equal vigor are allowed to develop from the same point. If one of them is headed back the effect will be a much stronger union, because of the fact that one outgrows the other.

Deep cultivation of the soil in orchards is in effect a system of root pruning. It can be practiced to good effect among trees inclined to heavy wood growth, as it encourages the formation of fruit buds instead of wood. Where the object is to stimulate wood growth cultivation should be very shallow and frequent. Clean cultivation is always desirable whichever result is sought, that of wood growth or fruit production.

THE CODLING MOTH AND ITS TREATMENT.

By A. L. Melander.

The Codling Moth is a brownish miller about one-half inch in length, which lays eggs on or near apples. In a little over a week the eggs hatch into Codling Worms. In nearly all localities two distinct broods of worms occur each year. After feeding within the apple for several weeks the worms leave the fruit to cocoon. Most worms make their cocoons in the ground, many can be found beneath rough bark. The



Different Stages of Codling Moth—all natural size.

cocoon stage is completed in from two weeks to a month during the summer. Worms leaving apples late in the summer remain in the cocoons over winter. When the cocoon stage is completed the Codling Worm has changed to the Codling Moth, and is ready to lay its eggs.

HOW TO COMBAT THE CODLING MOTH.

The only remedy for the Codling Moth is spraying. Other measures are useful but can not be depended on alone. Clean culture, especially stirring up the ground beneath the trees, is of great importance as it destroys the worms in their cocoons. Banding trees with burlap will trap 40 per cent. of the worms.

Apples should be thinned so that no two touch. Trees should be pruned so that they can be easily sprayed and cultivated. A new orchard should be set with trees thirty feet apart to allow for passage for the spraying outfit in the future.

SPRAYING.

After the Codling Moth has entered the apple spraying does no good. The object of spraying is to provide a coating of poison through which the worm will have to eat its way. Many worms enter where apples touch. If the fruit is thinned so that no two apples touch the worm is more likely to get poisoned. Most of the early worms enter apples at the blossom end. In order to place poison in the blossom end a spraying must be given just after the petals fall and before the calyx cup closes. This will be several weeks before the first worms are hatching but must be given. It is the most important spraying of all. The other sprayings should be given just as the first worms of each brood are hatching.

HOW TO TIME THE SPRAYINGS.

The time for the first spraying is definitely fixed. But there is more doubt as to when the other sprayings should be given. The best time for spraying can be easily ascertained by the following simple method. In a quart glass jar place a number of cocoons obtained from the trunk of an infested tree. This jar should have a cloth cover and should be placed in the shade in the orchard. Add ten days to the date when the moths first appeared in the jar, to allow for the hatching of the egg and the date for the second spraying is obtained. Obtain some new cocoons a month or so later and rear the moths of the second brood in the same way. The date for the third spraying is thus found. A fourth spraying should be given one month after the third in the warmer localities.

WHAT TO SPRAY WITH.

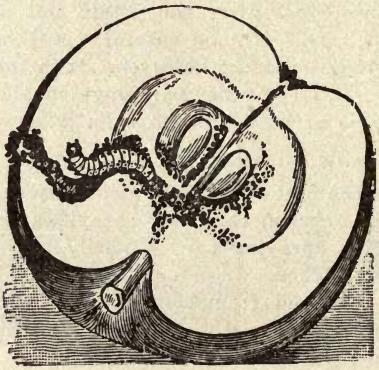
Lead arsenate is giving better satisfaction than any other substance. Lead arsenate can be obtained on the market most economically as Swift's Arsenate of Lead or as Disparene. Mix two pounds of lead arsenate paste with fifty gallons of water. Give three or four sprayings, which are necessary. One spraying alone will do no good.

Lead arsenate sticks well and shows up well on the apple. An ordinary rain will not wash it off. It can not scorch. It has given such good results that it is the cheapest insecticide in the long run.

If lead arsenate can not be obtained use one pound of Paris green to 125 gallons of water. Add the Paris green to two pounds (no more) of freshly slaked lime in mixing. Keep this mixture constantly agitated while spraying.

HOW TO SPRAY.

Be thorough. One spraying properly done is better than a dozen incomplete sprayings. Every side of every apple



CODLING MOTH LARVA.

must be sprayed. If an apple is only partly covered it will probably become wormy. Use as much force as possible; the mixture will penetrate better, spread better, and stick better. The one object of the first spraying is to get poison into the calyx cup. To do this it is necessary to force the spray through the crown of stamens. Spray downwards into the flowers with all the force possible until the flowers are dripping. An angle at the end of the extension rod is a convenience. The other sprayings must be made crosswise and upwards, as the aim is to coat the fruit with poison. Use whatever nozzle will break up the spray into a mist with the pressure available,—Vermorel for hand pumps and the Bordeaux

type for power. The best results have been obtained by using the power pump and throwing plenty of a rather coarse penetrating spray. By this means from 90 per cent. to almost the entire crop should be saved. But above everything else, be thorough.

SAN JOSE SCALE.

The San Jose Scale has become so generally distributed to the fruit sections of this state that most growers of tree fruits are familiar with its destructive effects. It may be

SAN JOSE SCALES—enlarged about three diameters.

found on all kinds of fruit trees, and on native trees contiguous to the infested orchards, but is most noticeable on apples and pears. When present on a bearing tree it always attacks the fruit, causing conspicuous red blotches. Most persons do not like to eat scaly fruit. Raw animal matter has not come to be a coveted relish when served upon fresh fruit, or otherwise.

The San Jose Scale does not appear in broods at stated intervals, as is the habit of some other insects. It lives through the winter on branches and twigs from the infant stage to that of full development. The scales as observed

during the dormant season are from about a thirty-second to nearly one-eighth of an inch in diameter. They are of a grayish color, nearly circular in shape, and almost flat, with a pointed, slightly raised center of lighter color. They devour the vital forces of a tree to such an extent that it ceases to be profitable, and will finally die if left untreated.

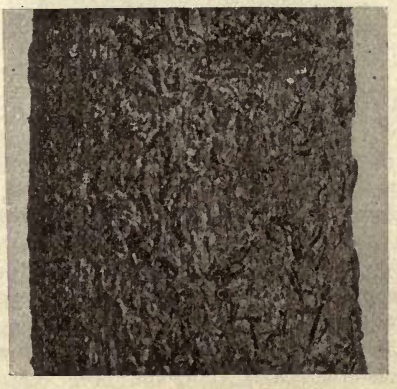
Beginning with the first warm weather in May the scales commence to multiply and so continue to increase through the season. The young are born alive and become immediately active in their destructive work of sucking the juices from the plant.

It is not a difficult matter to control and even to eradicate this pest from an orchard, by use of the sulphur-lime spray properly prepared and thoroughly applied.

The writer of this article has used the sulphur-lime spray in June with excellent success by applying the standard formula made up to one-half strength. F. A. H.

OYSTER-SHELL SCALE.

The Oyster-Shell Scale, so common west of the Cascade mountains, has a different life history from that of the San



OYSTER-SHELL SCALES—enlarged about three diameters.

Jose Scale. It winters in the egg stage, the eggs being protected until they hatch in the warm spring weather, by the shell or dead covering of the old scale. Otherwise they are similar in their destructive habits. The same treatment applies to both. Mr. E. S. Ridge, Fruit Inspector for Pierce county, and many others as well, testify to the effectiveness of the Sulphur-Lime Spray for the Oyster-Shell Scale, when this solution is made and used properly. F. A. H.

APHIS (Green and Black.)

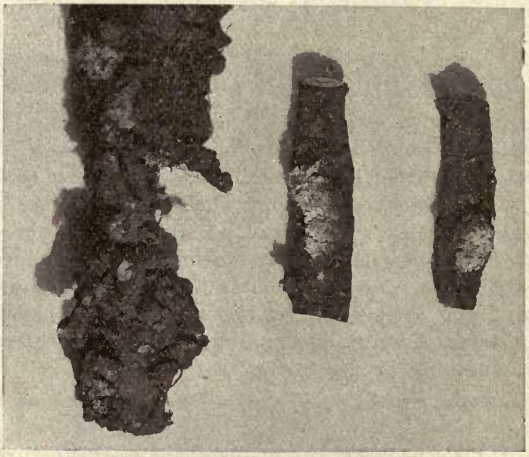
The aphis which attacks the foliage of the apple is usually of a light green color, and those found on the plum and other stone fruits are commonly black. Many kinds of plants are infested with aphides of varying shades of green merging to black. The females give birth to living young through the summer. Near the close of the warm season eggs are deposited on the twigs, and these hatch the following spring, and so continue the cycle of development. Aphides cause injury to young trees, nursery stock, and newly set grafts, principally by hindering or destroying leaf action.

The common remedy is kerosene emulsion used as a spray. The remedy I have found best by extensive practice is a preparation of nicotine, a by-product in the manufacture of tobacco for the trade. This is a syrupy liquid put up and sold in one and five gallon cans, and extensively used as a sheep dip for ticks, and by greenhouse men to kill insects infesting tender plants. It is offered to the trade under the names, Sheep Dip, Rose Leaf, Black Leaf, Nicoticide and other trade names. The cost is $1.00 to $1.25 per gallon and is diluted with about 75 parts water for application. A strong tobacco tea made from the refuse of cigar factories and used as a spray is an excellent substitute for the commercial nicotine products.

A thorough spraying with sulphur-lime solution before the foliage starts will destroy the eggs, thus we gain another important advantage in the use of this valuable remedy which is considered the standard for scale insects. F. A. H.

WOOLLY APHIS.

This insect is rarely found anywhere except on apple trees. It is most common in the Coast Region, though in other sections it is sometimes quite numerous. The white cottony substance which forms a covering and protection to the soft-bodied insects beneath, appears so conspicuous that its presence is readily observed. It attaches itself to rough places

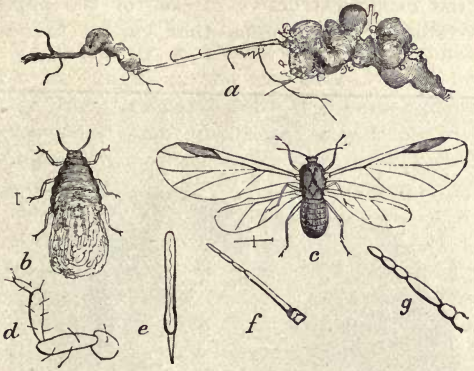


WOOLLY APHIS—on root and branches.

in the bark, in openings caused by wounds, where branches have been cut off, and about the buds and fruit spurs on small branches. It impairs the vitality of the tree when allowed to develop in considerable numbers. The sulphur-lime spray helps to keep it in check, but kerosene emulsion is a more effective remedy. Pure kerosene applied with a paint brush to the trunk and main branches where it is found seems to result in no injury to the tree and will kill the insects. It is a difficult pest to eradicate.

It is said that a "root form" of woolly aphis attacks the roots of apple trees. Some authorities claim the so-called root form is entirely a different insect, and it is named the

"apple-root aphis." While not as common as the woolly aphis working in the tops, it is even more destructive when found. Galls which resemble crown-gall are produced on the small roots by its attack. A remedy recommended for this is to remove the earth from around the base of the tree and treat with kerosene emulsion. This pest is likely to be introduced on nursery stock and serves as a warning to the planter for close inspection. F. A. H.



APPLE-ROOT APHIS—*a*, Infested Root; *b*, Larva; *c*, Perfect Insect.

THE PEACH TWIG-BORER.

This insect has come to be a serious pest in some of the peach-growing communities in this state. The first attack is made upon the young twigs in the spring by the larvae (worms) boring into the tips. A late brood infests the fruit, and it is the late varieties of fruit that indicate the greatest loss to the fruit-grower.

The adult is a small dark-gray moth which reaches maturity in August and later. The moths lay their eggs in the crotches of the smaller branches. When the eggs hatch the larva bore into the bark and there remain until the following spring.

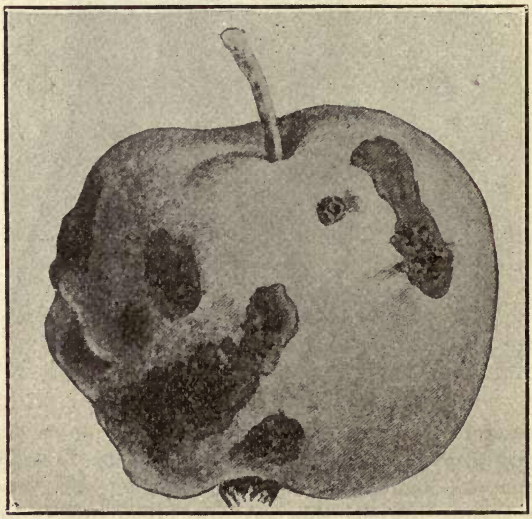
The Kerosene Emulsion Spray will destroy the worms if thoroughly applied late in the winter or early spring. In

treating for this pest it is advisable to use an elbow on the end of the spraying rod, and direct the spray downward into the crotches with considerable force. F. A. H.

APPLE SCAB.

By W. H. Lawrence.

This is the most destructive disease of the apple that occurs in the state. The fungus that causes the disease has



Scab—on the Apple.

two stages—the winter stage which lives in the dead and decaying leaves during the winter and the summer stage which lives on the leaves and fruit during the summer.

The form in the dead leaves continues to grow during the winter. Sometime in late winter or early spring capsules are formed inside the leaves. Each capsule contains numerous spores. About the time the leaves on the apple tree begin to

unfurl in spring and later these spores escape from the capsule and float about in the air. Some of them lodge on the leaves, flowers and fruit. If they germinate they will cause the parts to become diseased. The summer stage then makes its appearance in a few days in the shape of small, usually nearly circular, dark, olive green colored blotches. These blotches are composed of numerous short stalks on the tips of which summer spores are borne. The summer spores mature at once and drop off. If they lodge on the leaves and fruit of the same tree or a neighboring one they will cause new areas to become diseased. Very shortly a second crop of summer spores is produced by the fungus in the new areas which in turn drop off. Some of them are carried by the wind and other agents to the leaves and fruit and thus spread the disease more widely. Summer spores mature in such a short time and are produced in such abundance that thousands of scabby spots appear in the course of a few days when conditions are favorable. As the parts mature the new blotches become less frequent and finally cease to appear. The greater number of them appear during the interval of time between the unfolding of the leaves and a few days after the petals have fallen. The reason that the fungus no longer produces new diseased areas is perhaps due to the epidermis (skin) of the leaves becoming somewhat thicker and firmer and thus more resistant so that the fungus is unable to make an entrance.

Since the fungus that causes the disease winters in the dead leaves it is evident that the destruction of as many of the fallen leaves as possible will materially lessen the number of winter spores to be set free in the spring. Plowing the leaves under in the autumn is perhaps the easiest method of getting rid of a greater number of them. This will not altogether prevent the disease. The trees must be sprayed every year.

Several sprays have been used in combatting apple scab but none has given as good results as properly prepared Bordeaux mixture. Two applications applied on the proper dates are sufficient to hold the disease in check. The first application must be made just before the flower buds open and the second just after the petals have fallen.

BLACKSPOT CANKER.

By W. H. Lawrence.

Blackspot Canker is a disease of the apple tree. In importance it ranks next to the apple scab. It is very prevalent and destructive in Western Washington in localities where the rain-fall is considerable during the latter part of autumn and early winter. The disease is caused by a parasitic fungus

Canker Patches — on Apple Tree Branches.

The fungus lives in the bark for about a year and then dies. Before it dies it forms spores the greater number of which are distributed from October to late December or a little later. These spores are carried about by the wind and some of them lodge on the bark of apple trees. The moderately low temperature and plenty of moisture usually present in November and later are conditions most suitable for germination. On germinating the fungus enters the bark. Occasionally by the end of a week new cankers make their appearance, They are about the size of a pin head, circular, somewhat sunken, and

nearly black. They increase slowly in diameter but the fungus penetrates the bark into the sap wood beneath. When the tree begins to leave out the cankers increase rapidly in diameter and are mature in size by the last of June or a little later. Mature cankers are usually oblong and vary in size from ¼ of an inch to 6 inches long by ¼ of an inch to 5 inches in width. Frequently they appear to be much larger. As a rule these larger ones are the result of two or more smaller ones merging together. The cankered bark becomes dry and brittle and separates from the living, leaving a fissure. It remains on the tree for a time and then falls out, leaving a scar.

About the time the cankers are full grown the epidermis (skin) on the cankers become slightly roughened by the formation of pustules just beneath it. Each of these pustules contains numerous spores which when distributed will cause the new cankers to appear.

Since the spread of the disease is caused by spores and the spores germinate in November it follows that the way to prevent the disease is to prevent the germination of the spores. This can be done by spraying the trees with double strength Bordeaux mixture about the first of November to kill the spores on the bark. Under ordinary weather conditions there will be sufficient spray on the bark to kill spores that may lodge on it for a short period of time if the work has been done properly. To catch the spores that are distributed later in the season spray a second time with double strength Bordeaux mixture making the application thorough so that the entire tree is covered with the spray. The second spraying should be done two or three weeks after the first. In rainy weather three or more sprayings may be necessary to keep the bark protected.

CROWN-GALL AND HAIRY-ROOT.

A report of investigations by Mr. George G. Hedgcock of the U. S. Department of Agriculture on Crown-Gall and Hairy-Root, indicates that they are two separate and distinct diseases, which is contrary to the belief by some that these are two forms of the same disease. Much remains yet

to be learned about these diseases of which the Gall is the more common. It is found on the roots of various kinds of fruit trees and other fruit-bearing plants, and other plants as well.

The above report says, galls often occur in connection with hairy-root, but these are results of wounds rather than a

CROWN-GALL — on Apple Root.

form of this disease. "Apple crown gall is of two types," says the report. "A hard callous form is common on grafted trees at the union of the root and scion, and at any other point of the root system where wounds occur in either the cultivation or transplanting of trees." "A second type is a soft form more common on seedlings," meaning seedling stock used for grafting. In my opinion this "soft" form may be the same as that designated as the "callous" form, being soft by reason of the softer tissues of young seedlings.

All forms of root disease should be rejected and destroyed both by the nurserymen and planters.

No remedy for this disease has yet been found, and much concerning it remains to be studied. F. A. H.

GUMMOSIS.

The gummy exudations often seen on cherry trees and other stone fruits, indicate defective nutrition. It is the transformation of large groups of tissue into a waste product with which goes the vital forces of the tree. Young trees suffer great loss of vitality when so affected and will often die. Imperfect nutrition may be brought about by: excessive moisture, poor drainage, a dry subsoil, and a lack of the proper elements of plant food. Cherries should be planted on well prepared land, and attention always given to good cultivation. Wherever gum appears it should be removed, then the parts should be cleaned, and an application or two of orange shellac varnish made upon the parts affected. I wish to emphasize the value of this treatment with orange shellac varnish.

To prepare the varnish take pure alcohol and add enough orange shellac scales to make a liquid of the density of thick cream. Apply the varnish with a brush. When dry it is resistant to moisture. It is well to have the surface dry when the application is made. There is no better dressing for wounds of all kinds on plants than this varnish. It is better than waxes for dressing cut surfaces after pruning.

Orange shellac varnish is an antiseptic. F. A. H.

PEAR BLIGHT.

This disease is sometimes called "fire blight," as an infested tree has the appearance of being scorched by fire. The leaves and twigs turn black, and if neglected will continue to die downward. It has been fully determined that pear blight is caused by a species of bacteria, exceedingly minute germs, which gain entrance to the soft growing tissues of the plant through the blossoms or wounds, and circulate in the sap. Bees will carry these germs from an infested tree to others when in bloom. Owing to the nature of the attack, external remedies cannot be made to reach the disease. The only remedy is to cut out the diseased branches, and it is best to cut about a foot below the apparently diseased portion, as a fresh attack does not always have a surface indication. The

knife or whatever pruning instrument is used should be dipped in a rather strong solution of carbolic acid after each cut is made to avoid spreading the germs by contact.

Growers should use extraordinary care to prevent the introduction of pear blight to their localities, for sooner or later they are sure to experience considerable loss if it is allowed to spread. F. A. H.

BORDEAUX MIXTURE AND ITS PREPARATION.

By W. H. Lawrence.

Bordeaux mixture is composed of a number of compounds formed by pouring together solutions of bluestone and the milk of lime. The chemical changes taking place are very delicate, and in order that these may take place correctly great care must be exercised in mixing. The method of mixing has not only an important bearing on the chemical, but also on the physical, nature of the mixture. The most valuable of the compounds, and one which is easily modified in the mixing, is a bluish, gelatinous precipitate having about the same specific gravity as the fluid in which it is suspended. In mixing the Bordeaux by the different methods used by the orchardists the following gave the best results, and is the only one recommended:

Sulphate of copper (blustone)	6 pounds
Quick-lime	4 pounds
Water	50 gallons

To prepare 50 gallons of Bordeaux mixture, weigh out 6 lbs. of bluestone and place it in a sack; suspend the sack from a stick laid across the top of a barrel, so that the bottom of the sack hangs clear of the bottom of the barrel. Pour in enough water to cover the bluestone. As soon as all the bluestone has dissolved take out the sack and add enough more water to make 25 gallons. Bluestone is readily dissolved in hot water and the use of this will facilitate rapid preparation when work is rushing. Slake 4 lbs. of good quick-lime in a barrel, taking care to do it in such manner that when the lime is all slaked the mass will be a smooth paste, free from small particles of unslaked or burned lime. In order to get

the best results great care must be taken. After placing the lime in the barrel, add enough water to wet it thoroughly, and when the lime begins to dry and crumble add more water, being careful not to add enough to chill it. By pouring on a sufficient amount of water to keep the lime from burning a smooth paste is formed, free from grit and small lumps, provided a good quality of lime has been used. Having slaked the lime, add enough water to bring the mass up to 25 gallons. Stir the lime thoroughly through the water and it is then ready for mixing with the blustone solution. Two men are required to do this mixing properly. The solutions of lime and bluestone should be poured together slowly, and in such a manner that the solutions will mix in falling. When mixed, stir thoroughly, using a wide, wooden paddle. After straining, the mixture is ready for use.

There is some danger of not having sufficient lime to unite chemically with all the bluestone—it is best to test the mixture to see if sufficient lime has been used. Fill a saucer with the solution and add to it a few drops of a solution of ferrocyanide of potash (one ounce to a half pint of water). If a brown color appears, add more lime paste to the mixture, stir in thoroughly and test a second time. Add lime until the brown color does not appear when test is made.

SULPHUR LIME FORMULA.

Lime	1 pound
Sulphur	1 pound
Water	3 or 4 gallons

First slake the lime, using only enough water to keep it moist so it will all dissolve and not burn. Reduce to a thick paste, then add enough water to make a thin liquid. Put in the sulphur, stir it thoroughly before cooking and occasionally while cooking. If the cooking vat is large enough all the water can be added at first, but if not it can be put in later. To boil constantly for one hour is enough, as it is claimed it can be cooked too long. When the sulphur is all dissolved the liquid will be of an amber color. It should be poured into

the spraying tank through a strainer to remove the residue that would clog the nozzle.

It is a common mistake to use too much lime in the preparation of the sulphur-lime solution. Too much lime destroys the caustic properties of the sulphur and renders the spray less effective. It is best to use this preparation while fresh, or nearly so, and according to the above formula.

F. A. H.

KEROSENE EMULSION.

Kerosene	2 gallons
Whale-oil Soap (or 1 qt. soft soap)	½ pound
Water	1 gallon

Dissolve the soap in the water by boiling, and pour this boiling hot into the kerosene, away from the fire. The mixture is then to be agitated violently, preferably by pumping it back on itself with a force pump. After a few minutes the mixture becomes creamy in consistency. If well made, the emulsion will stand for a long time without free oil rising to the surface. Unless otherwise stated, use 1 gallon of the emulsion to 15 to 20 gallons of water in spraying.

PARIS GREEN.

Paris Green	1 pound
Good Lime	1 pound
Water	125 gallons

Slake the lime in a little water and then mix in the Paris green to form a thin paste. Strain the paste into the water so as to remove all lumps.

See article on the Codling Moth for Arsenate of Lead formula, the most modern of the poisonous sprays.

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YB 47358